

The Claims Defining the Invention are as Follows

1. A pump for conveying a pumped fluid using a actuating fluid, the pump comprising a rigid outer casing defining an interior space, a tube structure accommodated in the interior space, the tube structure being flexible and substantially inelastic, the interior of the tube structure defining a pumping chamber for receiving pumped fluid, the tube structure being movable between laterally expanded and collapsed conditions for varying the volume of the pumping chamber thereby to provide discharge and intake strokes, tube structure being maintained in a taut condition between the ends thereof, the region of the interior space surrounding the tube structure defining an actuating region for receiving and accommodating actuating fluid, the pumping chamber being adapted to receive pumped fluid to cause the tube structure to move towards the expanded condition and the pumping chamber thereby undergoing an intake stroke, the pumping chamber undergoing a discharge stroke upon collapsing of the tube structure in response to the action of actuating fluid in the actuating region.
2. A pump according to claim 1 wherein one end of the tube structure is closed and the other end is connected to a port through which pumped fluid can enter into and discharge from the pumping chamber as the pumping chamber performs intake and discharge strokes.
3. A pump according to claims 1 or 2 wherein the tube structure is supported at the closed end thereof.
4. A pump according to any one of claims 2 to 3 wherein the closed end of the tube structure is movably supported to accommodate longitudinal extension and contraction of the tube structure.
5. A pump according to any one of claims 2 to 6 wherein the closed end of the tube structure is movably supported in any appropriate fashion such as by way of a spring mechanism.

6. A pump according to any one of claims 2 to 5 wherein the actuating region comprises a actuating annulus substantially surrounding the tube structure and a actuating chamber located at the closed end of the pump.
- 5 7. A pump according to claim 6 wherein the actuating annulus is in fluid communication with the actuating chamber.
8. A pump according to any one of the preceding claims comprising means to bled fluid, such as air, from the pump.
- 10 9. A pump according to claim 8 comprising separate means to bled air from the pumping chamber and actuating region, wherein the air is bled from the pumping chamber during the intake stroke and air is bled from the actuating region during the discharge stroke.
- 10.A pump according to any one of the preceding claims comprising a monitoring means to monitor the pump during the intake and discharge stroke.
- 15 11.A pump according to claim 10 wherein the monitoring means monitors the condition of the tube structure.
- 12.A pump according to claim 10 or 11 wherein the monitoring means monitors, directly or indirectly, the position of the closed end of the tube structure.
- 20 13.A pump according to claim 10 wherein the monitoring means monitors the pressure differential between components of the pump.
- 14.A pump according to any one of claims 10 to 13 wherein the monitoring means at least indicates when the discharge and intake strokes have been completed.
- 25 15.A pumping system comprising a pump in accordance with any one of claims 1 to 14, a delivery means for delivering pumped fluid to the pumping

chamber in timed sequence for causing the pumping chamber to undergo an intake stroke, and means for supplying actuating fluid to the actuating region in timed sequence to cause the tube structure to laterally collapse whereby the pumping chamber undergoes a discharge stroke.

- 5 16.A pumping system according to claim 15 wherein the delivery means comprises a delivery pump.
- 17.A pumping system according to claim 15 or 16 wherein the actuating fluid is of any appropriate form, such as hydraulic oil or water.
- 10 18.A pumping system according to claim 17 wherein the actuating fluid is hydraulic oil.
19. A pumping system according to claim 18 wherein the supply means includes a hydraulic circuit incorporating a reservoir for hydraulic oil and a hydraulic pump.
- 15 20.A pumping system according to claim 19 wherein the hydraulic circuit also includes an intake and exit valve system for regulating the delivery of hydraulic oil into, and the discharge of hydraulic oil from, the actuating region in timed sequence.
- 21.A pumping system according to claim 17 wherein the actuating fluid is water.
- 20 22.A pumping system according to claim 21 wherein the supply means comprise a water reservoir at an elevated location in order to supply the water at the appropriate pressure head.
- 25 23.A pumping system according to any one of claims 15 to 22 wherein the delivery of the actuating fluid to the actuating region is at an opposed end to the port through which pumped fluid enters into and discharges from the pumping chamber.

24. A pumping system according to any one of claims 15 to 23 wherein the outlet of the actuating fluid from the actuating region is also at an opposed end to the port through which pumped fluid enters into and discharges from the pumping chamber.
- 5 25. A pumping system according to any one of claims 15 to 24 comprising two pumps in accordance with claims 1 to 14 operating sequentially such that the pumping chamber of one pump performs an intake stroke while the pumping chamber of the other pump performs a discharge stroke, and vice versa.
- 10 26. A pumping system according to claim 25 wherein the sequential operation of the two pumps is such that a generally uninterrupted supply of pumped fluid is expelled from the pumping system.
27. A pumping system according to claim 25 or 26 wherein the duration of the discharge stroke is longer than the duration of the intake stroke.
- 15 28. A pumping system according to claims 25, 26 or 27 wherein one pump completes its intake stroke and commences its discharge stroke while the other pump is completing its discharge stroke.
- 20 29. A pumping system according to any one of claims 25 to 28 wherein the discharge stroke of one pump is completed by the time the discharge from the other pump is equal in flow to the desired flow of pump fluid from the pumping system.
30. A pumping system according to any one of claims 25 to 29 wherein the two pumps have a common delivery means and a common supply means, with appropriate valve systems controlling the sequence of operation.
- 25 31. A pumping system according to any one of claims 25 to 30 wherein the or each pump is oriented so that the closed end of the tube structure is elevated in relation to the other end thereof.

32. A pumping system according to any one of claims 25 to 31 wherein the delivery and exit of the actuating fluid to the actuating region is adjacent the closed end.

5 33. A pump for conveying a pumped fluid using a actuating fluid, the pump comprising a rigid outer casing defining an interior space, a flexible tube structure accommodated in the interior space, the interior of the tube structure defining a pumping chamber for receiving pumped fluid, the tube structure being movable between laterally expanded and collapsed conditions for varying the volume of the pumping chamber thereby to
10 provide discharge and intake strokes, one end of the tube structure being closed and the other end communicating with a port through which pumped fluid can enter into and discharge from the pumping chamber as the pumping chamber performs the intake and discharge strokes, the region of the interior space surrounding the tube structure defining an actuating
15 region for receiving actuating fluid, the pumping chamber being adapted to receive pumped fluid to cause the tube structure to move towards the expanded condition and the pumping chamber thereby undergoing an intake stroke, the pumping chamber undergoing a discharge stroke upon collapsing of the tube structure in response to the action of actuating fluid
20 in the actuating region.

34. A pump according to claim 33 wherein the tube structure is substantially inelastic.

25 35. A pump according to claim 35 or 36 wherein the port through which fluid enters the pumping chamber is at an opposed end to where the actuating fluid enters the pump.

36. A pumping system comprising

at least two pumps each having a pumping chamber accommodated in an actuating region,

a delivery means for delivering pumped fluid to each pumping chamber in timed sequence, causing each pumping chamber to undergo an intake stroke, and

5 means for supplying actuating fluid to each actuating region in timed sequence to cause a respective tube structure of the pumping chamber to laterally collapse and the pumping chamber undergoing a discharge stroke,

whereby the sequential operation of the at least two pumps expels a generally uninterrupted supply of pump fluid from the pumping system.

10 37.A pumping system according to claim 26 wherein each pumping chamber comprises a flexible and substantially inelastic tube structure.

15 38.A pumping system according to claims 36 or 37 wherein the pumping chamber has one end closed and the other end connected to a port through which pumped fluid can enter into and discharge from the pumping chamber as the pumping chamber performs intake and discharge strokes.

39.A pumping system according to claim 38 wherein the closed end of the pumping chamber is elevated in relation to the other end thereof.

20 40.A method of operating a pumping system in accordance with any one of claims 36 to 39 wherein the duration of the discharge stroke of one pump is longer than the duration of the intake stroke of the other pump, and vice versa, whereby, when operated sequentially, the pumping system delivers a generally uninterrupted supply of fluid.

25 41.A pump for conveying a pumped fluid using an actuating fluid, the pump comprising a rigid outer casing defining an interior space, a tube structure accommodated in the interior space, the tube structure having one end closed and in an elevated position in to relation to the other end, which communicates with a port through which pumped fluid can enter into and

5 discharge from the pumping chamber, the interior of the tube structure
defining a pumping chamber for receiving pumped fluid, the tube structure
being movable between laterally expanded and collapsed conditions for
varying the volume of the pumping chamber thereby to provide discharge
and intake strokes, the region of the interior space surrounding the tube
structure defining an actuating region for receiving actuating fluid, the
pumping chamber being adapted to receive pumped fluid to cause the tube
structure to move towards the expanded condition and the pumping
chamber thereby undergoes an intake stroke, the pumping chamber
10 undergoing a discharge stroke upon collapsing of the tube structure in
response to the action of actuating fluid in the actuating region.

42.A pump according to claim 41 wherein the actuating fluid enters the
actuating region adjacent the closed end of the pumping chamber.

15 43.A pump according to claims 41 or 42 wherein the tube structure is flexible
and substantially inelastic.

44.A pump as substantially herein described with reference to the drawings.

45.A pumping system as substantially herein described with reference to the
drawings.

20 46.A method of operating a pumping system as substantially herein described
with reference to figure 18.